MAR10-2009-006861

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Spin polarized tunneling and injection in organic semiconductors[1]

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In recent years, organic spintronics has emerged as a hot area of research leading to advances in their fundamental understanding with a potential for technological development [1]. Organic semiconductors (OS) with their good optical properties, combined with the possibility of weak spin scattering have provided high impetus to this field. The strong excitonic and polaronic mechanisms of charge transport in OS have been widely studied. However, their influence on spin transport processes is an open area that is just beginning to be explored. Given this scenario, another area that needs attention is to achieve efficient spin injection into OS. This is possible using conventional spin sources such as ferromagnetic metals or using ferromagnetic insulators such as a spin filter. The mechanism of tunneling provides many interesting attributes for spin injection. Recent studies showing large tunneling magnetoresistance in OS has given some significant results [2]. The fact that OS exhibit strong electron-phonon coupling provide additional information to our spin injection study at the FM/OS interface. The use of inelastic tunneling spectroscopy has shed interesting insights on the morphological ordering of the organic molecules at these interfaces. The study performed on OS, rubrene, corroborated with structural and transport measurements reveal the importance of these findings on spin injection efficiency [3]. In addition, exploring the (FM/OS) interface magnetism using polarized neutron reflectometry and SQUID has shown complex behavior. These studies provide valuable input for the optimization of our approach for spin injection and transport by improving the device structure, leading to enhanced spin signals. In addition, the use of spin filter as the injection source is currently being explored and shall be presented.

[1] Dediu et al., Nat. Mater. **8** (2009); V. Vardeny, Organic spintronics, Taylor & Francis, 2010.
[2] Santos et al. Phys. Rev. Lett., **98** (2007); Shim et al., Phys. Rev. Lett. **100** (2008).
[3] Raman et al., Phy. Rev. B (2009).

[1]Work done in collaboration with my advisor Dr. J. S. Moodera, Dr. J. Borchers and Dr. S. Watson at NIST and supported by NSF, ONR and KIST-MIT projects.
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